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THE MINERALS OF NOVA SCOTIA,

CANADA.

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THE HON. C. E. CHURCH,
Commissioner of Public Works and Mines.

SIR,—The following notes have been prepared to accompany the collection of Nova Scotia Minerals intended for the Paris Exposition, and are respectfully submitted.

Yours truly,

E. GILPIN, JR.,
Inspector H. M. Mines.

THE MINERALS OF NOVA SCOTIA.

The following description of the mineral resources of Nova Scotia is not intended to give more than a brief outline, sufficient to show their extent, position and variety.

This Province, forming the most easterly extension of the American Continent, south of the St. Lawrence, may for practical purposes be considered the point of America approaching nearest to Europe. It stands like a pier projecting into the Atlantic, and from its position seems marked to play an important part in the future of the continent. Were it even a barren and inhospitable land, its position would make it important as the future gateway of travel between Europe and the future centre of the continent. When, in addition to its position, it is displayed, as bordering on the richest fisheries in the world; as possessing an equable climate favourable to human longevity, and admitting of the most successful culture of the fruits, etc., of the temperate zone; and as abounding in coal, and ores of iron, gold, and many other minerals; it may confidently challenge comparison with the most favored of its neighboring provinces and states. The minerals which have hitherto received most attention are coal, iron, gold and gypsum; but manganese, antimony, copper, barytes, lead, clays, building stones, grindstones, etc., are important, although hitherto but partially developed, sources of wealth.

coal trade of the Gulf and River of St. Lawrence. The coal in these districts is similar in quality to that found on the opposite or eastern side of the island, being of a bituminous and coking character.

Passing to the mainland, coal occurs at Pomquet and Hallowell Grant.

The first district that is worked on the mainland is known as the Pictou Coal Field. This district covers an area of about 35 square miles, and is noted for the unusual development of some of its beds. There are sixteen seams known, from 3 to 34 feet in thickness. The coal is not as bituminous as that from the Sydney Coal field, but is still a coking coal, except in the case of a few seams. The coal from this district is used at the iron furnaces at Londonderry and Ferrona, and has a good reputation for steam purposes.

The Cumberland Coal field has not yet been explored over all its area, which is estimated at 400 square miles. Operations have been hitherto practically confined to Springhill and the Joggins. At the former place there are seven seams, from three to twelve feet in thickness, three of which are extensively worked. The coal is similar in character to that from the Pictou district, and is largely used on the Grand Trunk, Canadian Pacific, and other railways.

Coal is known in Colchester, Hants and Antigonish counties, but no attention has yet been paid to it.

The foregoing shows that there is a large supply of coal available in the province, and that the different qualities are suited for almost every domestic and industrial use.

The annual production of coal in the Province is steadily increasing. Home consumption is large, and will be greatly increased upon the completion of the large Iron and Steel Works being built at Sydney. In spite of the duty placed on coal by the United States, large amounts are sent to Boston, and adjoining towns. The coal exported to the United States is used principally for making gas in closed ovens, with the coke, ammonia salts, etc., as by-products.

The following table will serve to show the sales for the year 1899, and their distribution:—

	Cumberland.	Pictou.	Cape Breton.	Other Counties.	Total.
Nova Scotia:					
By Land	116,328	198,793	16 942	4,744	336,807
By Sea	.....	40,873	349,079	2,718	392,670
Total N. S	116,328	239,666	366,021	7,462	729,477
New Brunswick	229,961	42,901	54,527	115	327,504
Newfoundland	.....	131	106,591	33	106,755
P. E. Island	.....	40,604	24,273	2,004	66,881
Quebec	44,577	80,502	902,395	1,814	1,029,288
West Indies	.....	6,044	.....	.....	6,044
United States	15,412	.....	137,776	.....	153,188
Other Countries	.....	.....	.....	.....	.....
Total	406,278	409,848	1,591,583	11,428	2,419,137

The coal from all the districts of the province is suitable for iron and steel making, as it forms a strong and pure coke. The coke from some seams is in quality fully equal to that of the best Connelsville coke, which is taken as the standard in the United States.

IRON ORES.

The iron ores of Nova Scotia are varied and abundant, and have as yet received comparatively little attention.

In the western portion of the province, there are important deposits of red hematites and magnetites at Torbrook, Clementsport and Nictaux. The Torbrook mine in this district furnishes annually about 30,000 tons for the Londonderry furnaces.

On the opposite side of the Basin of Minas, in Cumberland and Colchester Counties, the Cobequid Mountains contain important bodies of limonite and carbonate ores, which have been worked for many years at Londonderry. The Cobequids continue to the eastward into Pictou county, and here the deposits consist of limonite and specular ores. In addition, the clinton shales contain numerous beds of red hematite, some of which are fifty feet in thickness. There are also important deposits of limonite and spathic ores in lower carboniferous strata. The iron of these ores runs from 35 to nearly 70 per cent., some of the ores ranking as good Bessemer, while all are good furnace ores. In this county the ores are in close proximity to coal and fluxes, and every railway facility exists.

The continuation of this ferriferous range reaches the Gulf of St. Lawrence at Arisaig. This locality has hitherto received little attention, but several beds of red hematite of good quality are known. These ores being close to shipping will probably be utilised for furnaces in Pictou and Cape Breton counties.

In Guysboro several large deposits of specular ore have received a limited attention, and similar deposits occur in

Richmond County. Upper Stewiacke, Grand Lake, Goshen, Selma, Pugwash and Brookfield, may be mentioned as points where important deposits are indicated.

In Cape Breton the presence of numerous deposits has been known for some time, but no mining or development work of any extent has been done. At Whycocomagh, in laurentian strata, are red hematite deposits, probably containing large amounts of ore. Promising deposits are known at East Bay and George's River. Loch Lomond, Big Pond, Smith's Brook, Lake Ainslie and Lewis Mountain, may be mentioned as yielding iron ores. The scheme, now being carried out, of erecting a large blast furnace plant in the vicinity of the coal mines will stimulate prospecting, and no doubt many more deposits will be found which may prove of value.

The following analyses will serve to convey an idea of the composition of some of the Nova Scotia iron ores :—

Cape Breton.

	Big Pond.	Whycocomagh.
Metallic Iron	61.39	60.90
Silica	9.04	10.80
Phosphorus	tr.	tr.
Sulphur	tr.	tr.
Alumina	..	1.40
Magnesia	1.22	1.64
Lime	..	1.85
Manganese	..	..
Water	1.53	..

Nova Scotia Proper.

	Pictou (Specular.)	Pictou (Limonite.)	Londonderry (Limonite).	Torbrook (Hematite.)
Metallic Iron	64.41	56.83	57.85	59.86
Silica	3.68	4.80	4.79	5.93
Phosphorus	.04	.07	.09	..
Sulphur	.16	trace.	.60	.11
Alumina	2.95	..	.56	3.14
Magnesia	0.46	..	.10	..
Lime	.41	.63	.15	2.16
Manganese	2.74	.20	.25	..
Water	..	..	10.71	..

GOLD FIELDS.

The Atlantic coast of Nova Scotia, from Canso to Yarmouth, is occupied by a series of very old rocks, whose age, certainly greater than the silurian, is still a subject of debate among geologists. These rocks, consisting of slates and quartzites, are broken through at numerous points by intrusions of granitic rocks, which have induced much local metamorphism. They have been folded by a force, acting at right angles to the general trend of the shore, into numerous plications, having a general east and west course. The folds have usually high dips, and the anticlinal crests, where cut off by denudation show layers or veins of quartz, intercalated with the slates and quartzites. These quartz fillings occupy the spaces formed between the layers of rock, by the compressing and elevating force, and are frequently auriferous.

These anticlinal crests are very numerous, and the veins in some of them have been worked for a long time. Recent experience has shown that the most productive veins lie close to the course of the anticlinal, and that many veins producing gold do not come up on one side of the anticlinal axis, and drop down again on the other side, but turn over and descend again without coming at all to daylight.

The veins vary in thickness from three inches to twelve feet, and their gold contents run in the worked veins from four pennyweights to twenty ounces per ton. In the richer veins, the gold usually occurs in zones or bands in the veins, lenticular in shape, and usually with a decided dip to the east or to the west. In some veins, however, the gold occurs in irregular pockets, apparently following no fixed law of deposition. The veins carry, in addition to gold, iron, copper, zinc, and lead sulphides, and frequently show considerable percentages of arsenical pyrites. These minerals are not valuable as a source of supply of the metals they are com-

posed of, but are sometimes saved in the mills to be treated a second time for the gold they contain.

Hitherto, mining on these veins has been carried to a limited depth only, the deepest shaft not having reached seven hundred feet, while the average depth does not exceed two hundred feet. The veins, being usually in firm rocks with well defined walls, are opened by shafts sunk on their dip.

Mining costs vary with the condition of each vein, but it may be asserted that the expenses of mining, pumping and hoisting are lower than in any similar class of works elsewhere. The compact nature of the rocks renders the workings, when proper precautions are taken to exclude surface waters, so dry as to give very small pumping costs.

The quartz passes from the mine without dressing, etc., to the mill, which is usually driven by steam. The mills are almost invariably stampers, and vary in size from five to thirty-five stamps. The pattern of the mills is based on the best United States models, with improvements suggested by local experience. As the quartz carries its precious burden, as coarse and free gold, amalgamation is carried on in the mortar and on plates. The gold bullion is of good quality, carrying little silver, and averages, I believe, about $19.25 at the mint.

The production of gold during the year 1899, was, in round numbers, about 30,000 ounces, from a dozen localities. The business, although small, is, when pursued methodically, remunerative, and is capable of unlimited extension, as there are numerous anticlinals unworked, and many more to be discovered in unexplored districts. The mines are all within easy reach of roads, and of the harbors along the coast, and aid is furnished by the Provincial Government in opening roads to new mines. The Nova Scotians make excellent miners, and prefer this work to almost any other occupation.

GYPSUM.

Few countries show such wide-spread and valuable deposits of gypsum as Nova Scotia. Here the mineral, as hard and soft gypsum, occurs with limestone, in measures of lower carboniferous age, in immense beds, frequently running for miles in white cliffs. Owing to facilities for shipment, the greatest development of gypsum mining has been effected in the vicinity of Windsor, in Hants county. The annual export from this district is about 150,000 tons, valued at about one dollar a ton. The rock is taken from open quarries, trammed to the vessels, and shipped to the United States, principally for agricultural purposes, although a considerable amount is used for construction purposes. Numerous deposits occur in the Island of Cape Breton, and are utilised to a small extent for shipments to Montreal and United States ports. The mineral is found of every grade of quality, and in many of the quarries it is of almost chemical purity. Locally it is used to a small extent, either applied directly as a dressing to the soil, or as the basis of several forms of fertilisers. The total production for the year 1899 may be estimated at about 170,000 tons. Free sulphur, borates, and salts of magnesia, occur in gypsum, but are not, as yet, found in quantities of economic value.

The occurrence of salt as crystals and layers in the gypsum, and in the form of brine springs in connection with the marls, etc , accompanying it, leads to the belief that boring operations would disclose workable deposits of this valuable mineral. As yet, however, no attention has been paid to this subject.

ANTIMONY.

Some years ago a valuable mine of auriferous Antimony ore was worked at Rawdon, in Hants County. Owing to legal and other troubles the mine has remained closed for some time. The ore was of good quality and decidedly auriferous. As the district in which the deposit was worked shows veins of ore over a considerable extent of ground, it is probable that it will again become a producer.

BARYTES.

Sulphate of Barytes is found at Five Islands, River John, Gay's River, Loch Lomond, etc. It has been worked intermittently at these places to supply local works. The output seldom exceeds a few hundred tons in any one year. Carbonate of Strontium is noted by the officers of the Geological Survey, as occurring at several points in the lower carboniferous limestones in Cape Breton.

MANGANESE.

Manganese ores are common in the carboniferous and devonian rocks of several parts of the Province. The most continuous mining of this ore has been carried on at Teny Cape, in Hants County. Here the ore is a very pure binoxide, presented as pockets and irregular veins in limestone. The annual production from this district has seldom exceeded 200 tons, most of which, it is said, is used by glass-makers There is a large district here showing signs of this ore.

Near Truro, and in connection with the limonite deposits of Pictou County, considerable amounts of a similar grade of

Manganese ore have been mined at different times. Promising deposits occur on the College lands, Lunenburg County.

In Cape Breton County, near Loch Lomond, a very good quality of the ore occurs in connection with limestone and slates, and is worked to a small extent. Hitherto only the high grade ores have been worked in Nova Scotia, and I am not aware of any deposit having been found adapted to the iron and steel makers' use. It is, however, reasonable to expect that where the ore is so abundant in its more concentrated state, that bodies must exist mixed with iron, etc.

Wolfram.—The occurrence of Wolframite, in quantity apparently of economic value, was announced some time ago from the Margaree River. But little has been done to test the extent of the deposit. The discovery of this mineral is interesting, as it frequently occurs with tin ore, a discovery of which in Nova Scotia would attract much attention.

COPPER ORES.

The copper ores of Nova Scotia have only recently received attention at all proportionate to their importance. The upper carboniferous measures extending through Pictou, Colchester, Antigonish, and Cumberland counties, show at numerous points deposits of copper ore; in places, of high grade, in other places more disseminated. During the past summer several mines have been opened on deposits of this character in Pictou and Colchester counties, and a smelter has been erected at Pictou to treat not only the local ores, but those from Cape Breton and other points on the Gulf of St. Lawrence. In the counties of Antigonish and Pictou, in devonian strata, associated with granitic and dioritic dykes, are copper deposits which have been tested to some extent and promise to be valuable. In the Island of Cape Breton the traces of copper ore are wide spread, and promise that some day Cape Breton will prove like its neighbor, Newfoundland, the seat of an important copper mining industry.

The felsites, etc., of laurentian age seem to be the principal

copper-containing rocks. At Coxheath, near Sydney, considerable development work has been done on a series of large lenses containing copper pyrites with some silver and gold. At Cheticamp, on the northwest coast of the island, development work has shown promising deposits of gold-bearing copper ores. Other places in the island containing copper ore are French Vale, Mira, Eagle Head, St. Ann's and Whycocomagh. It is expected that the smelter now approaching completion at Pictou will stimulate an interest in opening up the more promising outcrops.

LEAD.

The carboniferous limestones of Nova Scotia, already mentioned in this sketch, are frequently met carrying lead ore, as galena. Usually the ore as observed is finely disseminated, or segregated into small veins. At several points, however, in the Stewiacke district, in Colchester county, especially at Pembroke and Smithfield, the bodies of galena are large and important. At the latter point a deposit has been proved to contain ore in quantity to permit of working.

There is a probability of this deposit being opened out and utilized in the near future for supplying the home market, which is of considerable dimensions. As a rule, the silver percentages of the Nova Scotia galenas are not high, when they are met in the limestones, but samples from veins in older rocks have shown promising contents of both gold and silver.

At Cheticamp, Inverness county, an important silver-lead property is being developed.

Molybdenite is found at several points in Lunenburg and Cape Breton counties, in quantities which would repay working. Deposits of pyrites, of fair quality, are known in Cape Breton county, and in some deposits copper and nickel are reported as occurring in small quantities. No attention has, however, yet been paid to these ores.

The triassic trap and amygdaloid of the Bay of Fundy yield,

in profusion, zeolites, and the associated varieties of quartz. Nowhere, perhaps, in the world, can the collector of these minerals find a richer gathering ground.

The more common minerals applied to the builder's art are abundant and varied in Nova Scotia The marbles, granites, redstones, etc., of Nova Scotia, should find a wide market in the United States. In the counties of Cumberland, Colchester and Pictou there are numerous deposits of the best sandstone or freestone, of every variety of color and texture. Quarries have been opened at points most accessible to shipping, and a small trade has been built up with the neighboring provinces and the United States. As wood is almost universally used in Nova Scotia for structural purposes, the local market for all the varieties of building stones is limited. At numerous points on the Atlantic shore the granites, already referred to in connection with the gold districts, furnish excellent stone, of differing textures and shade. Small amounts have been used at Halifax in the fortifications, and for foundations, etc. A quarry at Shelburne yields stone satisfactorily used for street paving, and superior to the imported article.

The carboniferous limestones are sometimes used for structural and railway purposes. The Cobequid Mountains and some districts in Cape Breton contain syenites, red granites, gneisses, etc., of excellent quality. None of these stones have been quarried.

At West Bay, Ben Eoin, East Bay, and other points in Cape Breton, are deposits of marble of good quality and presenting many beautiful shades.

The Bras d'Or Marble Company have opened a quarry for marble on their property at West Bay. The quality of their rock appears good, and it should command a ready sale. There are large amounts of this marble burned into an excellent lime for use locally and in the neighboring provinces.

The measures already referred to as yielding building stone in Pictou, Colchester and Cumberland counties also yield stone, worked to some extent at Lower Cove, Cumberland county, into grindstones, snathes, whetstones, etc., In connection with

this reference to building stones and abrasive materials it may be mentioned that deposits of tripoli, infusorial earth and emery sand are met at numerous points, and are now being utilized.

Clays, suitable for firebrick, abound in the coal measures, and the manufacture of this article should pay well, as there is a considerable local demand at the collieries, furnaces, etc. A few small potteries supply the home market. The deposits of brick clay are abundant and excellent. Improved methods of manufacture, producing a better quality of brick, would greatly extend its consumption, as in the cities and villages the superiority of brick over wood for dwelling houses is being recognized more and more.

From these very brief notes it will be seen that although the area of the province is small, the mineral resources are large and varied, and the slow rate of their development is due chiefly to the inclination of the people to engage in the pursuits of fishing and lumbering, which yield ready returns with a small outlay of capital. The consolidation of the principal collieries of the Sydney district, under a wealthy syndicate of capitalists in the New England States, with a view to developing a large export of coal to Boston, etc., shows that outside attention is being drawn to the mineral resources, and it is believed that this is but the commencement of a large and widespread interest in the mineral wealth of Nova Scotia.

The coal, gold, copper, lead and silver ores are all held by the Crown, and can be leased on easy terms. Part of the iron ore is held in fee simple by the owners of the soil, and part belongs to the Crown. Licenses to search, covering five square miles, and running for eighteen months, can be procured for $30, and a lease of the mineral sought can be selected out of the license. The leases are of various sizes up to one square mile in extent. The gold and silver leases are for forty years; those of other minerals are for eighty years. These leases carry powers to expropriate any surface lands needed for mining purposes, and are unusually favorable. The royalties are: on coal, ten cents a ton; on gold, two per cent.

on the bullion valued at $18.50 an ounce. The iron ore royalty is five cents a ton, and so on.

The advantages of these titles proceeding directly from the government, are evident, and have been much appreciated by mining people, who find that they are met, in coming to Nova Scotia, not by grasping private individuals, but by a Government anxious to promote the development of mining.

Further information will be furnished on application to the Canadian Geological Survey, Ottawa, or to the Department of Mines, Nova Scotia.